



In Lumbar Degenerative Versus Isthmic Spondylolisthesis, Functional Outcomes are assessed after Surgical Decompression and Posterolateral Instrumented Fusion

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Abstract:

This study aimed to compare the functional outcomes of surgical decompression and posterolateral instrumented fusion in patients with lumbar degenerative and isthmic spondylolisthesis. The study involved 52 patients with single level, low grade lumbar degenerative, and isthmic spondylolisthesis, with a minimum follow-up of 24 months. The surgical procedure consisted of neural decompression and posterolateral instrumented fusion. Pain and disability were assessed using a visual analog scale (VAS) and the Oswestry Disability Index (ODI). The results showed that the most common sites for degenerative and isthmic spondylolisthesis were at the L4–L5 (88.5%) and L5–S1 (84.6%) levels, respectively. Both groups significantly improved VAS and ODI scores. The efficacy of surgery based on subjective satisfaction rate and pain and disability improvement was similar in both groups. Notable complications were also comparable in both groups. In conclusion, neural decompression and posterolateral instrumented fusion significantly improved pain and disability in patients with degenerative and isthmic spondylolisthesis.

Keywords: *Degenerative spondylolisthesis, Isthmic spondylolisthesis, Lumbar spine, Instrumentation, Fusion.*

Introduction

Spondylolisthesis is the displacement or slip of a vertebra on the vertebra below, with the two most common types being degenerative and isthmic. Most literature focuses on minimally invasive techniques and specialty instruments for treating lumbar spondylolisthesis in adults. However, few studies have investigated differences in functional outcomes between these two types. Lumbar degenerative spondylolisthesis is more common at the L4-L5 level, presenting with central spinal stenosis and intermittent claudication due to an intact neural arch. In contrast, isthmic spondylolisthesis has a primary site of stenosis in the lateral recess and foramina, with radicular pain at the L5-S1 level. These differences may affect functional recovery in affected cases. This study aimed to compare the functional outcomes of surgical decompression and posterolateral instrumented fusion in patients with lumbar degenerative and isthmic spondylolisthesis.

Methods

The study analyzed the clinical outcomes of patients with lumbar degenerative and isthmic spondylolisthesis, initially divided into two groups: A and B. The patients were aged over 18 years, had a slip percentage below 50%, refractory complaints after at least 3 months of conservative treatment, had significant or progressive neurological deficit, and had a follow-up period > 24 months. Patients with previous lumbar surgery, significant associated diseases, or lumbar congenital or traumatic lesion were excluded.

Preoperative imaging work-ups included standing plain radiographs and magnetic resonance imaging scans of the lumbosacral spine. Pain and disability states were assessed using a visual analog scale (VAS) and the Oswestry Disability Index questionnaire. All surgical procedures were carried out by a surgical team using a similar technique, including neural decompression by laminectomy and foraminotomy and spinal stabilization by posterolateral fusion, pedicular screw and rod instrumentation.

Postoperative adverse events were recorded, and patients usually started walking while wearing a rigid lumbosacral orthosis on the second day after the operation. Postoperative follow-up visits occurred at 6 weeks, 3, 6, and 12 months, and then annually. Plain anterior or Ferguson radiographs showed the bridging bone between the transverse processes, while computed tomography (CT) scanning was used only in symptomatic patients.

According to the North American Spine Society Low Back Outcome Instrument, patients selected one of the following responses regarding their satisfaction with the surgical operation at the latest follow-up visit: (1) surgery met expectations; (2) surgery did not meet all expectations but if the same disease again occurs, they would undergo the same procedure for the same result; (3) surgery helped but they would not undergo the same procedure for the same result; and (4) they are the same as or worse than they were before the surgery.

Results

The study used SPSS ver.11.5 for statistical analysis, comparing pre- and postoperative characteristics of patients with degenerative and isthmic spondylolisthesis. The most common sites for degenerative and isthmic spondylolisthesis were at the L4-L5 (88.5%) and L5-S1 (84.6%) levels. Surgery in both groups significantly improved VAS and ODI scores, with similar efficacy for pain and disability improvement in both groups. The overall subjective satisfaction rate was also similar in both groups.

Postoperative superficial wound infections occurred in patients with diabetes, all responding well to blood glucose control, antibiotic therapy, and local wound care. No deep infections occurred in any patient. Postoperative refractory radicular pain occurred in two cases in group A due to malpositioning of the peripheral screw. CT revealed underlying pseudoarthrosis in both cases, but only one patient consented to reoperation with anterior lumbar interbody fusion. Five other cases were unable to demonstrate osseous bridging fusion with plain radiographs, all clinically asymptomatic.

Demographic Data of the Treated Patients

| Group | Sex (Male : Female) | Age (years) | Follow-up (months) |
|------------|-------------------------|--------------------|--------------------|
| A (n = 52) | 24 (46.2%) : 28 (53.8%) | 49.2 ± 6.1 (43–74) | 34.7 ± 6.3 (25–61) |
| B (n = 52) | 20 (38.5%) : 32 (61.5%) | 47.3 ± 7.4 (38–72) | 43.6 ± 4.9 (26–65) |

Values are presented as number (%) or mean ± SD (range).

Prevalence of Spondylolisthetic Levels in the Treated Patients

| Group A (n = 52) | Frequency (%) |
|------------------|---------------|
| L3–L4 | 2 (3.8%) |
| L4–L5 | 46 (88.5%) |
| L5–S1 | 2 (3.8%) |
| L4–L5 & L5–S1 | 2 (3.8%) |
| Group B (n = 52) | Frequency (%) |
| L4–L5 | 8 (15.4%) |
| L5–S1 | 44 (84.6%) |

Improvement in Pain and Disability

| Group | Measure | Preoperative | Last Visit | Z | p-value |
|-------|---------------------------|--------------|--------------|------|---------|
| A | Visual Analog Scale | 7.23 ± 1.17 | 1.34 ± 1.85 | 4.39 | 0.001 |
| A | Oswestry Disability Index | 71.61 ± 1.57 | 22.07 ± 1.39 | 4.46 | 0.001 |
| B | Visual Analog Scale | 6.84 ± 1.91 | 1.92 ± 1.89 | 4.22 | 0.001 |
| B | Oswestry Disability Index | 63.53 ± 1.39 | 13.15 ± 1.52 | 4.41 | 0.001 |

Values are presented as mean ± SD.

Intergroup Comparisons for Pain Reduction, Disability Improvement, and Satisfaction Rate

| Measure | Group A (n = 52) | Group B (n = 52) | Z | p-value |
|---------------------------|------------------|------------------|------|---------|
| Visual Analog Scale | 5.88 ± 2.42 | 4.92 ± 3.22 | 0.94 | 0.34 |
| Oswestry Disability Index | 49.53 ± 21.55 | 50.38 ± 21.48 | 0.37 | 0.37 |
| Patients' Satisfaction | 1.38 ± 0.75 | 1.11 ± 0.32 | 1.25 | 0.21 |

Values are presented as mean ± SD.

Discussion

The study aimed to evaluate and compare the surgical outcomes of two common types of adult lumbar spondylolisthesis in 104 cases. Although many studies exist on the surgical results of these two types, few have focused on comparing them. Gehrchen et al. found an overall satisfaction rate of 70% without any significant difference in functional outcomes, with male gender, having a job, and being a non-smoker as good preoperative predictive factors. They also stated that surgical indications for lumbar spinal stenosis are more important than the surgery.

Lauber et al. evaluated the surgical outcomes of transforaminal lumbar interbody fusion (TLIF) in patients with low grade lumbar degenerative and isthmic spondylolisthesis in a prospective clinical study. They reported about a 10 point improvement on the ODI in all patients with a 94.8% fusion rate and a 7.6% reoperation rate. Their results showed that functional outcomes of TLIF in patients with isthmic

spondylolisthesis were significantly better relative to degenerative ones, although they recommended TLIF as a safe and effective treatment for both types and prevented typical adverse effects of anterior or posterior interbody fusion.

Moon et al. reported the results of anterior surgery in 26 cases treated by the modified extraperitoneal Bailey-Badgley fusion construct. They concluded that isthmic type spondylolisthesis has more inherent instability relative to degenerative spondylolisthesis and should not be performed routinely in these cases. In their study, although the type of surgery and the approach were completely different, the rate of pseudoarthrosis in the degenerative and isthmic types was not significantly different (7.7% vs. 5.8%; $p = 1.645$).

In conclusion, neural decompression and posterolateral instrumented fusion significantly improved pain and disability in patients with degenerative and isthmic spondylolisthesis. The efficacy of surgery on overall subjective satisfaction rate, pain, and disability improvement was similar in both groups. Neurologic decompressive surgery on lumbar nerve roots seems to be associated with satisfactory outcomes, regardless of the region of compression at the central canal, lateral recess, or foraminal area.

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